Benyon, David, Phil Turner and Susan Turner. **Designing Interactive Systems: People, Activities, Contexts and Technologies.** England: Pearson Education Limited, 2005.

**NOTES**

**Chapter One: Designing Interactive Systems: A Fusion of Skills**  
Interactive Systems need to be both usable for the task at hand but should also be considerate of the user experience.  
• The Product should be easy and enjoyable to use.  
• Part of the values of “being human centred” (Page 14)—the wants and needs of the users are considered first and the technology tailored toward those wants and needs.  
  
The key concerns of designers of Interactive Systems:  
• DESIGN: what is design and how should you do it?  
• TECHNOLOGIES: the interactive systems, products, devices and components themselves  
• PEOPLE: who will use the systems and whose lives we would like to make better through our designs  
• ACTIVITIES AND CONTEXTS: what people want to do and the contexts within which those activities take place  
(Page 10)  
  
Design can be scientific based or creative, most design incorporates the two.  
  
The user interface of interactive system are the parts of the systems people come in contact with, physically (buttons and knobs), perceptually (screens or noises) and conceptually (figuring out how to work the device using knowledge from the outside world and what we already know: see affordance, one of Norman’s design principles, in which the design of the object suggests it use to the user, page 65), when using a device (Page 12).  
  
Information Appliances (Norman in Benyon, Page 18)  
• Appliances should be everyday things that require everyday skills  
• Appliances have a clear, focused function that can be used in a variety of circumstances  
• Peer-to-peer interaction  
• Direct user interface  
• Closure  
• Immediacy  
• Personal and Portable  
  
Sociology, anthropology (ethnography especially) and psychology are help tools for interactive system designers to understand and design for people. (Page 21)  
  
Understanding the hardware and software of different technologies is important for interactive systems designers to help different devices communicate. (Page 22)  
  
Understanding the “community of practice” a new technology will be placed in helps interactive systems designers to tailor to different individual needs. (Page 23)  
  
Human-centred design can be more expensive but is more advantageous in the long run (Page 24-25):  
• Safety concerns are addressed  
• Effectiveness—productivity and acceptability  
• Ethics—intellectual property and respecting different viewpoints

# Chapter 2: PACT

**2.1 Introduction**

* Technologies are used to support a wide range of people undertaking various activities in different contexts
  + If technology changes then the nature of the activity will change also. Fig 2-1 (pg.30)

**2.2 People**

* Physical differences:
  + Height and weight
  + Different personalities, cognitive skills and preferences.
  + Variability in the five senses (sight, hearing, touch, smell and taste) has effect on accessibility and enjoyment levels of technology for different people in different contexts.
    - ex. color blindness
* Psychological differences:
  + psychologically, people differ in many ways:
    - people with good spatial ability will find it much easier to find their way around and remember a website than those with poor ability.
    - language differences fit in this category too.
    - attention and memory which are dependent on stress and tiredness.
  + The understanding and knowledge that we possess of something is often called 'mental model'
    - people that do not have good mental models can only perform actions by rote (memorization).
* Usage differences:
  + Novice and expert users of a technology will typically have very different requirements.

**2.3 Activities**

* Term used for very simple tasks as well as highly complex ones.
* 10 important characteristics of activities that designers need to consider:
  1. something that is undertaken every day (cell phone use) should be designed for easy use whereas something that happens only once a year (changing the battery) can be a bit more complex.
  2. time pressures, peaks and troughs of working: designs that work well when things are quiet can be awful when things are busy.
  3. Some activities are continuous whereas some are likely to be interrupted; the interrupted tasks should be designed so that finding one's place again is easy.
  4. Response time - is instant feedback crucial?
  5. Some activities can be carried out alone while some need the coodination and communication with others.
  6. well-defined tasks can be accomplished with simple step-by-step instructions; vague activities means that people will have to browse around, see different types of information and then move on.
  7. Some activities are safety critical- one mistake could ruin everything.
  8. in general it is vital to think about what will happen when a mistake is made and design for such circumstances.
  9. data requirement of the activity: large amount of data makes a key board a necessity.
  10. the media is just as important as the data: a two-tone display of numeric data demands very different design from a full motion multimedia display.

**2.4 Contexts**

* Activities always happen in a context, so there is a need to analyse the two together.
* Physical Environment:
  + the sun shining on an ATM display may make it unreadable
  + the environment may be noisy, cold, wet or dirty.
* Social Context:
  + a supportive environment will offer plenty of help for the activity.
    - training manuals, experts to lend a hand.
  + Privacy issues
  + Social norms may dictate the acceptability of certain designs.
* Organizational Context:
  + changes in technology often alter communication and power structures and may have effects on jobs such as de-skilling.

**2.5 Technologies**

* Interactive systems typically consist of hardware and software components and transform some input data into some output data.
  + Input: concerned with how people enter data and instructions into a system securely and safely.
  + Output: output needs to be considered, including the characteristics of different displays.
  + Communication: issues such as bandwidth and speed are critical. So too is feedback to people so that they know what is going on and indeed something is going on.
  + Content: good content is accurate, up-to-date, relevant and well presented.

**2.6 Scoping a problem with PACT**

* Aim of human-centred interactive system design is to harmonize the PACT elements in a particular domain.
* PACT analysis is useful for both analysis and design activities
  + to do PACT analysis: designer simply scopes out the variety of Ps, As, Cs and Ts that are possible.
    - For people: designers need to think about the physical, psychological and social differences and how these differences change in different circumstances and over time.
    - For activities: designers need to think about the complexity of the activity, the temporal features, cooperative features, and the nature of the data.
    - Contexts: think about the physical, social and organizational setting.
    - Technologies: they concentrate on input, output, communication and content.

**2.7 The process of human-centred interactive systems design**

* Activities in Design:
  + there are many ways of characterizing the activities involved in the design process.
    - David Kelley: design has 3 activities: understand, observe, visualize.
    - Smith and Tabor: 5 activities: understanding, abstracting, structuring, representing, detailing.
  + The book uses 5 activities: requirements, Conceptual design, physical design, prototyping and envisioning, evaluation Figure 2-5 (pg. 40)
    - Requirements:
      * concerned with what the system has to do, what is has to be like, how it fits with other things.
      * functional requirements: what the system should be able to do
      * and nonfunction requirements
      * requirements are generated through discussion with future clients or users of the system, and observations of existing systems and what people do.
    - Conceptual design:
      * designing a system in the abstract, about considering what information and functions are needed for the system to achieve its purpose.
      * deciding what someone will have to know to use the system.
    - Physical Design:
      * concerned with how things are going to work and with detailing the look and feel of the product.
      * structuring interactions into logical sequences and about clarifying and presenting the allocation of function and knowledge between people and devices.
    - Prototyping and envisionment:
      * designs need to be visualized both to help designers clarify their own ideas and to enable people to evaluate them.
      * concerned with finding appropriate media in which to render to design ideas.
    - Evaluation:
      * tightly coupled with envisionment because the nature of the representation used will affect what can be evaluated

**Chapter 3  
Introduction**

**Access** concerns removing the barriers that would otherwise exclude some people using the system at all.  
**Usability** refers to the quality of the interaction in terms of parameters such as time taken to perform tasks, numbers of errors made and the time to become a competent user (it may meet requirements of usability criteria, but may fail to satisfy audiences)  
**Acceptability** refers to fitness for purpose in the context of use.  
**Engagement** concerns designing for great, exciting and riveting experiences (aka ‘wow’ factor)  
 **Accessibility**

> Everyone should be able to have access to information that is delivered through software technologies  
>With an increasingly wide range of computer users and technologies, designers need to focus on the demands their designs make on peoples’ abilities  
>The sorts of issues that an ordinary user faces in an extraordinary environment (stress, time pressure) often are similar to the issues that extraordinary users (people with disabilities) in ordinary environments

> Reasons why people can be excluded from accessing interactive systems include:  
o They way a piece of equipment is set up (ie. An ATM machine is too high for someone who is in a wheelchair)  
o They may not understand how to use a piece of equipment (ie. Instructions are far too complicated)  
o Financially someone may be excluded because of affordability issues  
o Cultural exclusion occurs when designers assume they know how everyone around the world lead their lives (ie. Slogans/terms that may be common in Canada, may not be common in China)  
o Social exclusion occurs when equipment may not be available at appropriate times or places.  
>Two main approaches to designing for accessibility:  
o Design for all (universal design) is based on four premises:  
>Varying ability is not a special condition of the few, but a common characteristic of being human and we change physically and intellectually throughout our lives  
>If the design meets the needs to the disabled, it can be used by everyone  
>At any point in our lives, personal self-esteem, identity and well-being are deeply affected by our ability to function in our physical surroundings with a sense of comfort, independence and control

> Usability and aesthetics are mutually compatible  
o Inclusive design (says total inclusion is unattainable) As a way of ensuring an accessible system, designers should:  
>Include people with special needs in requirements analysis and testing of existing systems  
>Consider whether new features affect users with special needs (positively or negatively) and note this in the specification  
>Take account of guidelines, include evaluation against guidelines  
>Include special needs users in usability testing and beta tests  
o There are a lot of technologies that do cater to all audiences  
> the aim is to design to cater for the widest range of human abilities  
  
**Usability**  
 systems should be easy to use, easy to learn, flexible and engender a good attitude in people  
 the goal is concerned with efficiency and effectiveness of systems  
 A system with high degree of usability:  
o It will be efficient in that people will be able to do things using an appropriate amount of effort  
o It will be effective in that it contains the appropriate functions and information content, organized in an appropriate manner  
o It will be easy to learn how to do things and remember how to do them after a while  
o It will be safe to operate in the variety of contexts in which it will be used  
o It will have high utility in that it does the things that people want to get done  
 3 principles that Gould and Lewis use to meet usability:  
o Early focus on users and tasks (ie. Who the users will be, studying the expected work that would be accomplished, making users part of design team)  
o Empirical measurement (recording users reactions/reviews to the design developed)  
o Iterative design (problems in design are found and fixed, cycle of design, redesign, trials and error)  
o 4th principle: all usability factors must evolve together, and responsibility for all aspects of usability should be under on control  
 Another way to look at usability is to see it as concerned with achieving balance between the four principal factors of human-centered interactive system design, PACT  
o People  
o Activities people want to undertake  
o Contexts in which the interaction takes place  
o Technologies (hardware and software)  
 Important features of human-computer interaction (two relationships that need to be optimized)  
o The interaction between people and the technologies they are using (user interface)  
o Interaction between the people and technologies considered as a whole (the people-technology system), the activities being undertaken, and the contexts of those activities  
 Norman focuses on the interface between people and technology (the difficulty of turning goals into actions required by a user interface)  
o People have goals (devices typically only deal with simple actions- two gulfs must be bridged)  
o The gulf of execution- translating goals into actions. The gulf of evaluation- deciding whether the actions were successful in moving the person towards his of her goal  
o The gulfs need to be bridged semantically (do they know what to do/what has happened) and physically (can the person physically or perceptually find out what to do or what has happened)  
 Key issue of usability is that often technology gets in the way of people and the activities they want to do (we are conscious of bridging the gulfs)  
 Another key issue is to try to engender an accurate mental model of the system. A good design will have adopted a clear and well structured conceptual design that can be easily communicated to people  
  
**Acceptability**  
 Fitting technologies into people’s lives. Key features:  
o **Political**- new technologies have been introduced for simple economic reasons, regardless of what people may feel about them and the ways that people’s jobs and lives might change.  
o **Convenience**- Designs should not be awkward and should fit effortlessly into any situation.  
o **Cultural and social habits**- designs should not be ‘rude’ or disturb users. It has to do with the way people like to live (ie. Spam mail is unacceptable)  
o **Usefulness**- goes beyond efficiency and effectiveness and concerns usefulness in context (ie. Diary function on PDAs are usable, but not sufficiently useful for everyday living)  
o **Economic**- Price and value for people’s money. It goes further than that- it may completely change how companies conduct business and make their money.  
 Norman characterizes situation for a successful technology as a stool with three legs: user experience, marketing and technology  
  
**Engagement**  
 Qualities of an experience that really pull people in. Engagement is concerned with all the qualities of the interactive experience that make it memorable, satisfying, enjoyable and rewarding.  
 If usability is concerned with optimizing the PACT elements in some domain, then engagement is when the elements are truly harmonized.  
 Key features:  
o **Identity**- Authenticity- if you are engaged in some experience and something happens that suddenly reminds you that it is not real, then the authenticity of the experience can be lost. Identifying with a key element of engagement (are you a PC or Mac?)  
o **Adaptivity**- is to do with change and personalization with changing levels of difficulty, pace and movement. Engagement is not about making things easy, but enjoying them  
o **Narrative**- is to do with telling a good story, with convincing characteristics, plot and suspense.  
o **Immersion**- is the feeling of being wholly involved within something, with being taken over and transported somewhere else. Immersion is not about the medium, but about the quality of design  
o **Flow**- is the sense of smooth movement, the gradual change from one stage to another  
 A medium is engaging if it draws the person in, if it seems to surround the activity, if it stimulates the imagination.  
 Computer games are a good example of how it can be engaging. A feeling of immersion, the need for a good story line, the authenticity of the game play and identification with characters, the different levels accommodating different abilities and the gradual smooth change of scenes: the flow.  
  
  
**Design Principles**

* Design principles can guide the designer during the design process can be used to evaluate and critique prototype design ideas
* Systems should be learnable, effective and accommodating
* Designing interactive systems from a human-centered perspective is concerned with the following
* Helping people access, learn and remember the system:
  + Visibility- let people see what functions are available and what the system is currently doing. If it is not visible, make it observable. People should be able to recognize things instead of having to recall them.
  + Consistency- conceptual and physical consistency is important. (being consistent with design features, ways of working etc.)
  + Familiarity- Use language and symbols people are familiar with
  + Affordance- design things so it is clear what they are (ie. Make buttons look like buttons). It refers to the properties things have and how these relate to how the things could be used
* Giving them the sense of being in control, knowing what to do and how to do it
  + Navigation- provide support to enable people to move around the parts of the system: maps, directional signs and information signs
  + Control-make it clear who or what is in control and allow people to take control. (it is the most efficient if there is clear, logical mapping between controls and the effect they have)
  + Feedback- Fast feed back information from the system to people so that they know what effect their actions have had. (constant and consistent feed back will enhance the feeling of control)
  + Recovery- Enable recovery from actions, particularly mistakes and errors, quickly and effectively
  + Constraints- provide constraints so people do not do things they are inappropriate.
* In a way that suits them:
  + Flexibility- allow multiple ways of doing things so as to accommodate users with different levels of experience and interest in the systems
  + Style- designs should be attractive and stylish
  + Conviviality- interactive systems should be polite, friendly and generally pleasant

**Designing for Windows Applications**

* All the above principles apply to designing for windows.

**Design principles and website**

* Navigation- enables people to discover structure and content of the site and to find their way to a particular part of the site.
* Top banner- lets people know where they are, through clear and obvious labelling
* Navigation bar- down the left-hand side tells people where thy can go (also lets people know where they have been)
* The design principles are also implemented along with these features while designing a website
* These principles also apply to mobile phones and ubiquitous computing

**Overall**

* Access to interactive systems for all people is an important right
* Usability is concerned with balancing the PACT elements in a domain
* Engagement aims to harmonize the PACT elements
* Interactive systems design is different contexts and on different technological platforms

**Chapter 5:** **Human Psychology**  
  
Cognitive psychology (or Cognition): comprises those aspects of our mental life concerned with perception, reasoning, memory and attention, and language.  
· Cognitive psychology gave us information processing which draws very strong parallels between functioning of the brain and computers.  
**5.2: Cognitive psychology and HIP (human information processing)**  
· Human information processing paradigm:  
o Simplifies people’s abilities into 3 blocks  
§ Sensory input subsystem  
§ Central information processing subsystem  
§ Motor output subsystem  
· Very similar to main elements of computer  
· Fig. 5.1 pg. 100  
**5.3: A seven-stage model of activity**

* Norman argues that we start with a **goal**, set **intentions** to achieve this goal, and then translated into a **sequence of actions** which we then **execute**
  + **Gulf of execution**: problem of how an individual translates intentions into action
  + **Gulf of evaluation**: converse and refers to how an individual understands, or evaluates the effects of actions and knows when his or her goals are satisfied

**5.4: Memory**

* Working memory:
  + Short-term memory store holding material for up to 30 seconds and is very limited in size
  + Holding only 3-4 ‘chunks’ of information
* Long-term memory:
  + Effectively the inverse of working memory
  + Capacity is unlimited
  + Last from a few minutes to a lifetime
* Recall and recognition
  + Recall: individuals actively search their memories to retrieve a particular piece of information
  + Recognition: searching your memory and then deciding whether the piece of information matches what you have in your memory store
    - Recognition is easier and quicker than recall

**5.5: Attention**

* Central to learning, perception, operating a machine, using a computer and so forth
* Practice reduces the amount of attention required
* Closely coupled with awareness
* **Controlled processing:** makes heavy demands on attentional resources, is slow and limited in capacity, and involves consciously directing attention towards a task
* **Automatic processing:** makes no demands on attentional resources, is fast, unaffected by capacity limitations, unavoidable and difficult to modify, and is not subject to conscious awareness
* Vigilance: refers to detecting a rare event or a signal in a desert of inactivity or noise

**5.6: Visual perception**

* Concerned with extracting meaning from the light falling on our eyes
  + Detecting colour, shapes and the edges of objects

**5.7 The Gestalt Laws of perception**

* Proximity: objects appearing close together in space or time tend to be perceived together.
* Continuity: perceive smooth, continuous patterns rather than disjoint, interrupted ones.
* Part-whole relationships: the whole is greater than the sum of its parts
* Similarity: similar figures tend to be grouped together
* Closure: closed figures are perceived more easily than incomplete (or open) figures. This feature is so strong that we even supply missing information ourselves to make a figure easier to perceive

**5.8: Depth Perception:**

* *4 key primary depth cues:*
  + Retinal disparity: our eyes are approx. 7 cm apart; brain processes the difference and interprets it as distance information
  + Steropsis: different images of the world received by each eye are combined to produce a single 3d experience
  + Accommodation: we change the shape of the lens in our eyes in order to create a sharply focused image.
  + Convergence: over distances of 2-7 meters we move our eyes more and more inward to focus on an object at these distances.
* Secondary depth cues:
  + Rely on only one eye
    - Light and shade
    - Linear perspective
    - Height in the horizontal plane
    - Motion parallax
    - Overlap
    - Relative size
    - Texture gradient

**5.11: mental models**

* Mental model: cognitive representation of our understanding.
  + May have structure

**Chapter 6 Technology 1: supporting single user interaction:**  
In order to interact with a computer we need to be able to communicate with it and it with us. This is done by way of the user interface. We communicate with the user interface using one or more input devices, while the computer or interactive device communicates with us by way of an output device.  
  
**6.2 User interfaces:**

* command language is simply a set of words with an associated syntax.
* back in the day we used to operate off of ms dos, which is still available in windows.
* there were a defined set of words (commands) which a person could type in to receive a desired function.

**6.3 Graphical user interfaces (GUIs)**

* WIMP stands for windows, icons, menu and pointer, though it is thought by some to have been a term of abuse used by computer scientists of end-users.
* Window is a means of sharing a computer’s graphical display resources among multiple applications at the same time.
* icon is an image or symbol used to represent a file, folder, application or device, such as a printer.
* menu is a list of commands or options from which one can choose.
* pointing devices most common example would be a mouse.
* this form of interaction is called direct manipulation because we directly manipulate the on-screen objects.
* the computer we use today is a direct manipulation interface, because we can use the mouse to make changes directly to the graphical user interface.

**6.4 The major components of a GUI**  
  
Windows

* -windows allow a workstation’s screen to be divided into rectangular areas which act like separate input and output channels that can be placed under the control of different applications.
* users can see the output of several processes at the same time and choose which one will receive input by selecting its window, usually by lick on it with a mouse.

Menus

* most applications running on personal computers are menu-driven.
* menus should be grouped into menu topics, which are a list of menu items. Users select a command or option from the list, and an action is performed.
* hierarchical menus are occasionally also called cascading menus.
* pop-up menus are distinguished from a standard menu in that it is not attached to a menu bar in a fixed location. (Also known as contextual menu).

Toolbars

* -the toolbar is a collection of buttons grouped according to function.
* -the buttons are represented as icons to give a clue as to their function.
* -toolbars are also configurable.

**6.5 Form fill**

* from fill interfaces are used to gather information such as name and address.
* individual boxes are called fields and are frequently marked with an asterisk to indicate that an entry is mandatory
* Wizards
  + wizard is the name given to a style of interaction which leads the user by the metaphorical hand step-by-step through a series of questions that answers, pick-lists and other kinds of widgets to achieve a task.
  + wizards are used to install hardware and applications.
  + wizards represent a complex task in ‘bite-sized’ pieces.

**6.6 Input devices**

* touch screens
  + touch screens appear visually identical to a normal monitor but, the screens are sensitive to the touch of the finger.
  + they function through either infra-red sensitivity or electrical capacitance.
* light pens
* light pens were arguably the original pointing device.
* the mouse
  + the mouse has become the default pointing device.
  + a mouse might be cordless, using infra-red to communicate with the host computer.
* handwriting recognition
* problems with handwriting recognition include:

1. quite slow
2. inaccurate
3. requires the user to ‘train’ the device to recognize your handwriting
4. many people can type faster than writing by hand

**6.7 Output devices**

* display devices
  + monitor most fundamental output device.
  + output device is driven by hardware – a graphics card which with windows-based systems is likely to be a third party specialist deice and which will vary with respect to the screen resolutions and palette of colours it can support.
* data projectors
  + less resolution but usually results in a huge image projection.
* speech
  + speech synthesis works well enough (a) to understand what the computer is saying to us and (b) to do a pretty good job at pronouncing all but the most obscure of words. But like sound we generally do not use it.
  + speech synthesis cannot imitate the full spectrum of human cadences and intonations, but speech synthesis systems can read text files and output them in a very intelligible, if somewhat dull, voice.
  + screen reader produces synthesized voice output for text displayed on the computer screen, as well as for keystrokes entered on the keyboard.
* printers and plotters
  + a printer is a device that prints text or illustrations on paper, while a plotter draws pictures.
  + plotters differ from printers in that they draw lines using a pen.
* haptics
  + haptics refer to the sense of touch. However, haptics allow us to be in touch with interactive devices and media in a way which is direct and immediate.
  + most widespread haptic device is those game controllers which incorporate so-called force-feedback.
  + an example of haptics is the ‘silent alert’ vibration of a mobile phone.

**6.8 virtual reality (VR)**

* virtual reality can be divided up into 2 basic forms:
  + Immersive and non-immersive.
* Immersive virtual reality requires the users to wear a light-excluding helmet which houses the display, and a data glove which facilitates the manipulation of virtual objects within virtual reality.
* Non-immersive virtual reality, in contrast, is displayed on a computer’s monitor.
* while immersive virtual reality has captured the public imagination, desktop virtual reality is more commonly found.

**6.9 VR input and output devices**

* data glove
  + gloves equipped with sensors (data gloves) are able to sense the movements of the hand which are translated into corresponding movements in the virtual environment.
* Head-mounted display (HMD)
  + An HMD is a light proof and rather heavy helmet isolating the wearer from the world and consists of two colour displays located in line with one’s eyes and a pair of stereo earphones. An HDM also has a head tracker which provides information about the user’s position and orientation in space.

**Chapter 7: Embodied interaction**

**1: Ergonomics:**

* Ergonomics: scientific study of the relationship between man and his environment. Environment including ambient (temperature, humidity, etc) and working (design of machines, health and safety issues).  
  Recognizes, for example, that we have bodies which both facilitate and restrict the range and types of movements we can make.
  + Interested in: reaction times (how quickly we can respond), visual acuity (visual detail we can resolve), and reach (positioning of controls so we can reach them).
  + Seen by manufacturers as a major selling point and is important to ‘inclusive design’
    - Including older people in the design process.
* Anthropometrics: measurement of man
  + Tell us the limits of a human so ergonomics can determine what constitutes as too small and compact in the designing process.
* Fitts’ Law
  + Describes motor control. The smaller the target and the greater the distance, the longer it will take to hit the target.
  + Ex: the distance between <OK> and <Cancel> or worse <Fire> and <Detonate>

Embodied interaction 2: Avatars in CVEs

* CVE: Collaborative virtual environments
  + People are avatars
  + The surrounding area is data

Embodied interaction 3: Affordance

* Affordance: resource or support that the environment offers.

Theoretical perspective 1: Situated action:

* Formulation and execution of plans.
* Plans are formulated through a set of procedures beginning with a goal, successive decomposition into sub-goals and into primitive actions. The plan is then executed.
* BUT: the world is not stable, it is dynamic.
  + Thus plans are not executed but are just one resource which can shape an individuals behaviour

Theoretical perspective 2: Distributed cognition

* Distributed cognition: both cognitive process and knowledge used and generated are often distributed across multiple people, tools and representations.
* Internal representation: knowledge (human memory
* External representation: anything which supports the cognitive activity

Theoretical perspective 3: Activity Theory

* Core features comprise recognition of the role and importance of culture, history and activity in understanding human behaviour.
* CHAT: Cultural Historical Activity Theory
  + 3 basic principles:
    - Activities as the smallest meaningful unit of analysis
    - The principle of self-organizing activity systems driven by contradictions
    - Changes in activities as instantiations of cycles of expansive learning.
* Structure:
  + Subjects: one or more people
  + Object: purpose/product or output
  + Artefact: tools used
  + Community: All other groups that take stake in activity
  + Division of labour: horizontal and vertical divisions of responsibilities and power within activity
  + Praxis: formal and informal rules and norms governing the relations between the subjects and the wider community of the activity.
* Contradictions:
  + Primary: conflict at node
  + Secondary: conflict between two nodes
  + Tertiary: occurs when activity is remodeled to take account of new motives or new ways of working
  + Quaternary: occurring between different co-existing activities

# Chapter 8 – Scenarios

8.1 Introduction  
- Stories about people undertaking activities in contexts using technologies  
- Important approach to the design of interactive systems in the 20th Century  
- Carroll argues that scenarios are effective at dealing with 5 key problems of design  
1. External factors (time, lack of resources, existing designs)  
2. Single design impacts many areas  
3. Technology changes at a rapid pace so generic solutions are useless.  
4. Importance of reflection and action in design  
5. Slippery nature of design problems  
- Figure 8.1 on page 193 shows a diagram of Challenges and Approaches in scenario-based design  
- Rarely one design that fixes all problems  
- Claims analysis: identify key features of a scenario and lists good and bad aspects of the design  
  
**8.2 Scenarios throughout design**- Useful in: (5 key stages of interactive system design)  
1. Requirements work  
2. Prototyping  
3. Envisionment  
4. Evaluation  
5. Conceptual design  
6. Physical design  
- 4 types of scenarios  
1. User stories  
 Real world experiences of people  
2. Conceptual scenarios  
 More abstract descriptions  
3. Concrete scenarios  
 Generated from abstract scenarios by adding specific design decisions  
4. Use cases  
 Once concrete scenario process is completed these can be represented as use cases  
- Help to determine problems people are having  
  
User Stories  
- Real world ideas or experiences  
- Rich in context  
  
Conceptual Scenarios  
- More abstract than user stories  
- Similar stories are combined together  
- Useful for generating ideas and for understanding the requirements for the system  
  
Concrete Scenarios  
- Each conceptual scenario may generate a lot of concrete scenarios  
- Often identify problems that exist only under certain circumstances  
- Begin to dictate particular interface design and functions  
- Useful for prototyping, envisioning design ideas and for evaluation  
- Not a clear break between conceptual and concrete  
- The more specific, the more concrete  
  
Use Cases  
- Describes interaction between people and devices  
- How system is used  
- Describes what people do and what the system does  
- Design issues are resolved and a set of concrete scenarios are used as basis for design  
- Can be presented in the form of abstract diagrams to detailed “pseudo code”  
**8.3 Documenting scenarios**  
- Structure designed to organize scenarios  
- PACT framework used to critique scenarios  
- Must consider assumptions  
- Important to provide rich context  
  
Cross-referencing Scenario Types  
- Cross-reference user stories to conceptual scenarios through concrete examples and finally to the use cases  
**8.4 A scenario-based design method**  
- Method for formalizing the different types of design scenarios  
- Figure 8.5 on page 204 is an example of Overall scenario-based design method  
- Notice relationship between specifying design constraints and use of scenarios  
  
Requirements and problems  
- Issues and difficulties arise that help designer to determine requirements, qualities or functions of new system  
  
Scenario Corpus  
- Want to develop a representative and carefully thought-through set, or corpus, of scenarios  
- Designers gather a lot of information through the use of scenarios  
o Some detailed and some not  
- Designer pulls information and experiences together to create system  
- Rationale for developing corpus of scenarios is to uncover ‘dimensions’ of design situation and to demonstrate different aspects of those dimensions  
- Needs to cover all main functions of system and the events that trigger the functions  
- Might consist of several scenarios depending on complexity of domain  
  
Conceptual Model  
- Object or data model results from process of conceptual modeling  
- Shows main objects in the system, their attributes and the relationships that exist between them  
- Very important part of interactive systems design that is often overlooked  
- Well-designed conceptual model = easier to design  
- Forms the basis of the information architecture of a system  
  
Design Language  
- Consists of set of standard patterns of interaction and all physical attributes of a design  
o Colours  
o Shapes  
o Icons  
- Brought together with conceptual actions and objects and the ‘look and feel’ of design is completed  
- Defines key elements of the design  
o Colour  
o Style  
o Types of buttons  
o Sliders  
o Widgets  
o Principles and rules for putting them together  
- Consistent design language = more user-friendly

# Chapter 9 – Requirements

9.1 What are requirements?  
- Something a product must do or quality it must have  
- Take current design and use requirements to design new system  
- Additional requirements emerge during the design process  
- Requirements specification: Formal document which contains requirements  
- 2 types  
o Functional  
 What the system must do  
o Non-functional  
 Quality the system must have  
 Concern the way the functionality operates  
 Image, usability, performance, maintainability, security, cultural acceptability and legal restrictions  
  
Prioritizing requirements  
- Review with users and clients and modified when necessary  
- Use MoSCoW rules for categorizing  
o Must have - fundamental  
o Should have – essential if more time were available. System is usable without  
o Could have – Lesser importance  
o Want to have but Won’t have this time round – Can wait until a later development  
- MoSCoW rules are part of DSDM (Dynamic Systems Development) method  
  
**9.2 Participative design and requirements**- Requirements gathering  
- Requirements generation  
- Requirements elicitation  
- Requirements engineering  
- Involves using variety of techniques to understand and analyze someone’s needs and aspirations  
- Maintain human centered approach to design  
  
**9.3 Interviews**  
- Most effective ways of gathering information about what people want  
- Structured interview  
o Uses questions which are developed beforehand  
o People are limited to replies  
- Semi-structured interview  
o Pre-prepared questions sometimes  
o Can reword and appropriate where necessary  
o Start at broad level and get into more detail as interview progresses  
- Unstructured interviews  
o Use when very little background information is available  
o No preset questions or topics beyond general subject  
  
Stories, scenarios and early prototyping in interviewing  
- Aids to understanding  
- Prevent abstract thinking  
- Identify circumstances the new design will have to entail  
- Prototypes are used to embody scenarios in possible technology  
- Analyst and user ‘walk through’ scenario while analyst probes for comments or suggestions  
  
Think aloud commentaries  
- Low-level detail about current technology  
- Include internal cognitive processes  
- Useful in determining problems  
- Interferes with process you are studying  
- Not all cognitive processes can be accessed by conscious mind  
  
**9.4 Practical considerations in interviewing**Preparation  
- Get to know background  
- Understand the language  
  
Keeping track of the interview  
- Pair of interviewers is most effective  
- Audio or video tape is convenient but time consuming afterwards  
- Note-taking is helpful – create timestamps  
  
Telling stories  
- Can be misleading  
- Disproportionate emphasis  
  
Reflection and exploration  
- Reflecting back on the interview helps understanding  
- Have interviewee summarize at the end  
- Look over notes and get clarification if needed  
  
General-purpose exploratory questions  
- Help interview along  
- ‘Tell me about your typical day’  
- ‘Tell me three good things about’  
- ‘…Three bad things’  
  
When to stop  
- Balance practical constraints against comprehensiveness of the data  
- Stop once no new insights are formed  
  
**9.5 Obtaining information from people at a distance**- Most common – questionnaire  
  
Questionnaires: a cautionary note  
- Streamline requirements process  
- Good for large number of people  
- Creating a workable questionnaire is difficult  
  
Cultural probes  
- Developed by Bill Gaver and colleagues in working with elderly people located in three European cities  
- Aim was to design technologies which would foster greater participation in the community by older people.  
- Got to know the groups in person, then introduced them to cultural probes packages  
- Each person received collection of maps, postcards, disposable camera, and booklets  
o Each item stimulated interest and curiosity  
  
**9.6 Working with groups**- Alternative to questionnaires = focus groups  
- Facilitators pose questions and encourage reactions  
- Discussions flow more naturally  
- Can be enhanced by scenarios and prototypes  
  
**9.7 Observing activities in situ**  
- Compliment interviews and questionnaires by observing people in action  
- People describe how an activity is ‘supposed’ to be done, but not how it is actually executed  
- Also important to identify what you have not observed because things may not go wrong while you are observing  
- Being unobtrusive is difficult  
o The act of you watching someone work will make them act differently  
  
**9.8 Artifact collection and ‘desk work’**- Instead of using interviews, questionnaires and observation  
- Designers work does not just involve working with the users, desk work is involved during the design process  
- Desk work involves reading procedure manuals and other materials about the organization  
- Studying existing software  
- Collecting and analyzing documents that exist and documenting the movement of documents and the structure of object such as filing cabinets and ledger books.  
- Market analysis: looks at similar products that have been produced  
o Way of getting new ideas  
  
**9.9 Requirements and scenarios**- Requirements are easier to illustrate using scenarios as well as presented in organized list

**Chapter 12**

* By **evaluation**, we mean reviewing, trying out or testing a design, a piece of software or a product to discover whether it is learnable, effective and accommodating for its intended user population.
* **Usability** is defined as 'the extent to which a product can be used by **specified users to achieve specified goals with effectiveness, efficiency and satisfaction** in a specified context of use.
* Evaluation is concerned with different issues at different times during the development of a product or system
  + You might need to evaluate initial concepts
  + Paper prototypes/software can help
  + Evaluating competitor products/previous versions can also feed into the design process --> relates to how Rikako Sakai looked at previous Photoskitch models to compare and contrast (Tutorial 7 - <http://www.designinginteractions.com/interviews/RikakoSakai>)
* Testing will identify potential problems of the product
  + Perhaps not all data processing components may be fully operational
  + Perhaps the system may be completely functional but only in some parts
  + What is important is that you leave enough time to conduct the testing
  + If you make a note of problems earlier on in the process, you can fix them earlier on in the project, or justify evaluation work at an earlier stage in the next project
* Evaluation of the types described above is sometimes called **formative evaluation** because the results help to form the design
* Assessing the usability of a finished product
  + test against in-house guidelines
  + test formal usability standards
  + to provide evidence of usability required by a customer
* This type of evaluation is sometimes called **summative**.
* In participatory design approach, users help designers set the goals for the evaluation work. Involving users have great benefits in terms of eventual uptake and use of the technology.
* Long-term evaluations as a means of understanding the success: these might include problems reported by customers or end-users, customer reactions to salespersons' pitches or requests for modifications

**Norman's Principles** (review of chapter 3)

1. Visibility
2. Consistency
3. Familiarity
4. Affordance
5. Navigation
6. Control
7. Feedback
8. Recovery
9. Constraints
10. Flexibility
11. Style
12. Conviviality

**Chapter 15 What is memory?**

* Memory **is not** single, simple information store. It is made of short-term memory(very limited) and long-term memory( unlimited).
* Elaboration is to emphasize the similarites/differences among all items.
* Memory should be considered as a constructive process and not studied in isolation because it involves all aspects of cognition.

**How memory works?**

* Working memory( Short-term memory) has three components: Central Exec, Articulatory/ Phonological Loop, and Visuo-spatial sketchpad.
* Long term memory hold information in terms of the meaning. Long-term aid recognition of olfactory/gustatory encoding like smell of rotten food or sound of dog bark. Episodic and Autobiographical memory are both based on personal history. Semantic and procedural are two components of Long-term memory.

**How and why do we forget?**

* Two issues related to forgetting are Accessibility and Availability.
* Accessibility is related to the inability to retirieve info stored in memory.Related to Short-term memory.
* Availaiblity is concerned with whether the information was stored to begin with. Related to Long-term memory.

**Forgetting from Short-term memory?**

* Decay theory: Memory fades with time.
* Displacement theory: to store info others have to be squeezed out.

Forgetting from Long-term memory?

* Interferency Theory: Forgetting influenced by what we did before and after learning.
  + Interference has two forms: Retroactive Interference(works backwards) and Proactive Interference(earlier info affects new learning).
* Retrieval failure Theory\*\*: Incorrect retrieval cue causes inability to retrieved stored information.

**Chapter 19 Reading Summary**  
UED: User Environment Design  
**19.2 The affinity Diagram**  
- Simple and effective  
- Based on needs, requirements, wishes and hopes on a technical system to support safety-critical training  
Constructing an affinity diagram

1. Write each requirement, wish or need on a Post-it.
2. Repeat until you have at least a few hundred
3. Affinity diagram is built bottom-up by choosing common themes and structure. Choose you own headings
4. Post-its should be affixed to a wall and sorted into groups
5. Record the groups and the headings

The creation of affinity diagram = first step in design process because we can see features, properties and expected behaviours of new system.  
**19.3 Consolidation**- Most difficult part  
- Bring together all the different kinds of models  
o Flow, Sequence, Artefact, physical and cultural  
o All different points of view  
- How can the system be redesigned?  
- Review work models that have been created  
- Look for common problems  
- Brainstorm possible solutions  
Using flow models to review roles  
- Best starting point for overview of work practice and people’s roles within it  
- When designing an interactive system, look for:  
o People have more than one role  
 Consistency would enable easier transitions  
o Minimize overloaded roles  
o Avoid ‘role isolation’  
 Communication must be easy  
o Review ideas for change against fundamental purpose of organization  
Sequence models as sources of ideas for redesign  
- If an activity is kept, consider:  
o Can intent be achieved in a more effective way?  
o Are all steps necessary?  
o Different ways people undertake different roles  
 Some more effective than others  
o Additional intents  
 Make sure design process will satisfy them  
o Eliminate unnecessary steps and breakdowns  
o New design should not create more work  
Considering artefacts  
- Embody structure of work the artefact supports and underlying intents  
- Gives clues as to where process isn’t working well  
- Aspects to consider in reviewing role of artifacts in new design process:  
o If redesign intention is to put artefacts online, consider how many informal communications will be supported  
o Can some elements of artefact be completed automatically?  
o Does the presentation highlight most important aspects?  
Constraints and values from cultural models  
- Reveals little about structure and process  
- Focuses on values and attitudes  
- Look for areas where sensitive use of interactive systems can alleviate irritations  
- Be careful of deeply held values  
- Be aware of impact of changes on power relationships between stakeholders.  
Clues for redesign from the physical models  
- Hold more clues to how people actually carry out work in the environment in which they find themselves  
- Frequently used artefacts must be at hand  
- Need to be aware of how environment helps and hinders the work:  
o Don’t implement on-line equivalent if physical environment is currently working well  
o Consider impact of changes on the way tasks are currently supported by physical features.  
o Look for breakdowns which can be fixed with new system  
o Consider how physical system can be modified  
 Usually left up to customer

**19.4 Developing a Vision**  
- Vision – mixture of sketch and text which defines elements of new system  
- Main creative task in Contextual Design process  
- Decide what new system should do  
- Aim to:  
o Review ideas that have been captured in informal consolidation process against models of work and contextual data you have collected.  
o Establish how client wants to project image of itself through its information system.  
 Cultural model will help here  
o Outline main function of new interactive system  
o Involve all members of design team  
- Define how new design works in detail  
o Capture strands of interaction in storyboards  
o Develop structure for the system in UED  
o Paper prototype with users  
**19.5 Constructing a Storyboard in Contextual Design**  
- Used to ground vision of new system in work practice to make sure it fits with the larger system.  
- Shows how real task will actually work  
- CD storyboards incorporate significant interactions between users and between users and other artefacts.  
Step One:  
- Identify key user tasks which will be supported with new system  
o Choose One  
- Review models and affinity diagram for any issues relevant to task.  
Step Two:  
- Produce detailed redesign for task using text and diagram  
o Not a storyboard yet  
- Consider alternative options  
Step Three:  
- Compare redesign with original  
- Check that intents are met  
Step Four:  
- Sketch storyboard  
- One frame for each step in task sequence  
- Include interaction between people, automatic and manual steps as well as interactions with system  
- Not the place to consider details of user interface design  
Step Five:  
- Repeat for all key tasks  
- Review storyboard with design team  
**19.6 The User Environment Design (UED)**- Used to develop finished product  
- User-centred, high-level design for interactive application which are intent on implementing.  
- User-friendly  
- UED used to guide detailed design of the system, design of user interface and management of developing process.  
UED Basics  
- Diagram:  
o Based on underlying structure and sequence of work itself  
o Shared resource for designers, developers and project managers  
o Constructed before user interface design takes place  
o Similar to website navigation map or floor plan  
- Comprises a number of focus areas  
- Focus areas – places in the system which support particular parts of the work  
o Collects functions and work objects into one place to support a particular part of work  
o Should be named with simple active phrase which is the *purpose statement* and is numbered so that it can be referenced unambiguously.  
- Each focus area comprises primarily:  
o Purpose statement  
 Describes purpose of focus areas  
o Functions  
 Enable user to do the work  
 Described with short phrase and are invoked but user or system  
o Objects  
 Things the user sees and manipulates in focus area - include people and artefacts  
o Links  
 Pointers to other related focus areas  
o Constraints  
 In implementation on focus area  
o Issues  
 Ideas for UI, unresolved problems  
o Hidden focus areas  
 Parts of the system that the user knows about but does not interact with  
o Roles  
 List of users expected to use this focus area  
Building a UED form storyboards  
- Constructed by walking through each storyboard frame by frame, identifying new focus areas and adding functions, links to existing focus areas.  
- Check for the following:  
o Overlapping focus areas  
o Unnecessary functions  
o Function areas that contain only links – remove  
o Focus areas that contain more than one task – simplify  
Checking for UED with a walkthrough  
- Things to check for:  
o Focus areas coherent?  
o Support one task in overall activity?  
o Check for focus areas without obvious purpose.  
o Avoid single-function focus areas.  
The UED and user interface Design  
- User interface design is concerned with accessing the functions identified in the focus areas of the UED.  
o Contents of a focus area in UED may translate into one screen or one window, but split screen may be better.  
o Remember different roles may use same focus area  
o Compare design with issues discovered in affinity design diagram and work models  
**19.7 Paper Prototyping**- Means of communicating with users and bringing them into design process  
- Animated user interface design  
- Employed in following ways:  
o Have users walk through existing task as designer makes the prototype ‘work’  
o Ask users why they take particular action with prototype and what they expect to happen  
o Take notes of user reaction, suggestions, confusion  
o Involve users in review of general scope of organization of functionality  
o Check effectiveness of more complete and detailed user interface design  
o Use ‘replay’ of prototyping session to communicate to rest of design team  
- Prototyping session should be structured similar to Contextual Interview.  
o Into to process, walkthrough, concluding session  
- Resulting feedback is used to revise UED and user interface design

# ****Chapter 20 TASK ANALYSIS****

- looking at the tasks people do or will have to do is necessary to human centre design

## ****20.1 Goals, Tasks and Actions****

task analysis – a specific view of interactive systems design which leads to specific techniques  
  
task – a goal together with some ordered set of actions  
  
detailed definition of task analysis:  
- work achieved by a work system changing a application domain  
o application domain or domain is an abstraction of the real world relevant to the work system  
o work systems in HCI can have one or more human or computer components  
- tasks are the means by which a work system changes a domain; means by which work is achieved  
- goals are a desired states of a domain that the system should achieve by the task  
- system performance is satisfactory when goals are achieved in domain by tasks  
- task analysis is the study of how work is achieved by tasks

### Goals

Goal – state of domain that a system wishes to achieve; specified at particular levels of abstraction  
- this definition allow for artificial entities to have goals  
  
agent – people and software systems which actively and autonomously try to achieve some state of domain  
  
technology – physical device, information artifacts, software systems and other methods or procedures  
  
- goal can be achieved in a variety of ways; one way:  
1. agent must decide which technology to use to achieve the goal  
- selection depends on agent’s knowledge of function, structure and purpose of technology  
2. once decided tasks can be defined

### Tasks and Actions

Task – structured set of activities required, used, or believed to be necessary by an agent to achieve a goal using a particular technology  
- can consist of subtasks  
  
subtask – a more detailed level of abstraction  
  
structure (of an activity; plan or method) – includes selecting between alternative actions, performing actions numerous times and sequencing of actions  
  
action – a task which has no problem solving associated with it and does not include any control structure

### Task Analysis Methods

Logic of the task – sequence of steps that need to be undertaken by a work system to achieve a goal  
  
Cognitive task analysis – understanding what cognitive processes the work system will have to undertake to achieve a goal  
- cognitions include: thinking, problem solving, learning, memory, mental models  
  
- for goals, tasks and actions consider…  
o procedural knowledge:  
• goal task mapping: knowing what to do to achieve goal  
• task action mapping: know how to do it  
• goal formation stage: first of all, knowing you can achieve a goal  
o structural knowledge: domain concepts and their interrelation  
• useful for problem solving

## 20.2 Task Analysis and Systems Design

- task analysis will result in a task model  
o a task model can take various forms  
  
- task analysis techniques and methods involve:  
o optionally, parallelism or non standard actions  
o goal of using notation  
o usability for communication  
o usability for modeling tasks  
o adaptability of a task analysis technology to new systems, aims or requirements  
  
- task analysis techniques are usually mono-teleogical  
  
mono-teleogical – the assumption that the agent or system has a single purpose or goal  
  
teleogy – study of purposes, causes and reasons  
- usually missing from task analysis techniques  
  
- task analysis is undertaken at different times during development for different purposes  
o during analysis task analysis is concerned with practice of work and function between people and technology  
o during design and evaluation task analysis is concerned with cognition demanded by a design, the logic and future distribution  
  
- three task analysis techniques:  
1. HTA hierarchical task analysis  
2. GOMS goals, operators, methods, selection rules; procedural knowledge  
3. ERMIA entity relationship modeling of information artifacts; structural knowledge

## ****20.3 HTA****

HTA – graphical representation of a task structure based on a structure chart notation  
  
Structure charts – a sequence of tasks, subtasks and action as a hierarchy and include notational concentions to show whether an action can be repeated a number of times (iteration) and the execution of alternative actions (selection)  
  
Sequence – shown by ordering left to right  
  
- HTA is not easy  
o Must spend time getting descriptions of tasks and subtasks correctly to be represented hierarchically  
  
→ Annett’s step by step guide on how to do an HTA:1. decide on purpose of analysis2. define task goals3. data acquisition; how to collect data?4. Acquire data and draft hierarchical diagram5. Recheck validity of decomposition with stakeholders6. Identify significant operation and stop when the effects of failure are no longer significant7. Generate and test hypotheses concerning factors affecting learning and performance  
  
- HTA highly effective with helping people to really understand structure tasks

## ****20.4 GOMS****

- most famous and long lasting  
- focuses on cognitive processes required to achieve goal  
  
goals – what people trying to do using system  
operators – actions system allows people to make  
methods – sequences of subtasks and operators  
selection rules - -rules people use to choose between methods of achieving the same subtask  
  
- this method is applicable only if people know goal  
- not suitable analytical method where people are problem solving  
- applicable to single user system interaction  
- need to describe, organize and structure tasks, subtasks and actions hierarchically

## ****20.5 Structural Knowledge****

- mental modal can be used to analyze tasks  
o two mental spaces: goal and device  
  
goal space – describes the state of the domain that the person is seeking to achieve  
device space - -describes how technology represents the goal space  
  
- mental map is analogous to real maps and can be used for tasks  
  
ERMIA entity relationship modeling of information artifacts  
- can represent concepts in peoples minds  
- relationship between entities annotated with 1 or m (more)  
- entities represented with boxes, relationships with lines and attributes with circles  
  
- basis of ERMIA → looking for entities and relationships and representing them as diagrams  
  
- key feature use same notation to represent conceptual aspects of a domain and perceptual aspects  
  
- menus have 2 entities (header – item)  
- relationship of H-I is 1:m because one heading can have many items  
- TRUE relationship between H-I is m:m because the item can be under many other headings  
o Very complex relationship and can be replaced with m:1 entity  
  
- ERMIA represents both physical and conceptual aspects of interfaces enabling comparisons and evaluations  
o Presents clear view of different models can be used for process of reasoning about models  
- can be used to navigate through information structures to retrieve pieces of information and estimate number of steps to get there  
  
→ Step by step to developing ERMIA models1. take some analysis and requirement work drawing up a task begin to sketch perceptual or conceptual interface2. identify major entities and relations with one another3. begin to sketch out entities and relationships4. replace m:m with new m:1 entity5. iterate and work with the sketch analyzing and identifying more relationships and looking for characteristics of the entities

**CH.29: UNDERSTANDING**

**Social Psychology**-made contribution to our understanding of cooperation.  
People behave differently in groups, they conform to others behaviour, rely on lack of contribution going unnoticed.  
  
Group Formation goes through phases:  
**Forming ---> Storming ---> Norming ---> Performing ---> Decay**  
  
**Forming**: anxiety about groups, dependence on a leader, finding out tasks and rules.  
**Storming**: Conflict between individuals, rebellion  
**Norming**: Stable, cohesive group  
**Performing**: Energy is directed to task  
**Decay**: Task is achieved, group dissolves.  
  
**Group Productivity:**  
Social loafing--> Weak group identity, not cohesive  
Social Compensation-->Individuals work harder to make up for lazier colleagues.  
Production blocking--> Ones contribution gets in the way of others.  
  
**CSCW**  
Computer Supported Cooperative Work (or working)  
Group ware: Software designed to support group working  
  
**8 CHALLENGES**  
  
-->the disparity between who does the work and who gets the benefit  
-->Critical mass and prisoners dilemma problems  
-->Social, political and motivational factors  
-->Handling in workshops  
-->Designing for infrequently used features  
-->Underestimated difficulty of evaluating groupware  
-->The breakdown of intuitive decision making  
-->Managing acceptance (A new challenge for product development)

**Chapter 30**  
Groupware: Interactive systems that support cooperative work, computer supported cooperative work  
  
Collaborative Virtual environments(CVEs): online digital places where we can be in touch, play together and work together regardless of geographic location.  
  
Space-time matrix proposed by DeSanctis and Gallupe is the idea that people may work at the same location or from different location, or may be working at the same time or at different times. (think of what different dimensions might be relevant)  
  
Synchronous-supporting technology: Netmeeting(chat), LiveBoard(shared whiteboards), DeskTopConference(application sharing), file transfer(ftp – widely used software application), Electronic Meeting Systems(Group support systems, group decision support systems, meetingware)  
  
**Core-dimensions include:**  
• Awareness: individuals working together need to be able to gain some level of shared knowledge about each other’s activirties. Provides a context for your own activity.  
• Articulation work: cooperating individuals must somehow be able to partition work into units, divide it amongst themselves and after the work is performed, reintegrate it  
• Appropriation(or tailorability): how an individual or groups adapts a technology to their own particular situation, the technology may be appropriated In a manner completely unintended by the designers.  
  
Workflow Technology: Any technology designed to give order to or record the progress of work activities over time. A workflow system manages the order in which tasks are executed and the flow of information.